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Engineering Controls for Reducing Continuous Mining Machine Noise

Objective

To develop effective noise controls for continuous mining machines (CMMs) to reduce worker noise exposure.

Background

Noise-induced hearing loss (NIHL) is an occupational illness caused by chronic exposure to excessive sound levels. For underground coal mine workers, NIHL continues to be a serious health issue. Analysis of hearing loss data suggests that by retirement age, 70%–90% of U.S. coal mine workers will have a hearing impairment. Operated in the confined spaces of underground mines, large industrial mining equipment often produces sound levels that can be harmful to workers. Of all equipment used in underground coal mining operations, CMMs account for the most noise overexposures. To reduce the occurrence of noise overexposures, engineering noise controls must be developed for the CMM.

Approach

Engineering noise controls address noise at the source to reduce sound levels and prevent NIHL. Noise generated by CMMs mainly results from three operational component systems: dust collection, cutting, and conveying. Of these three systems, the onboard conveyor system was found, through field and laboratory studies, to be the dominant noise source. Since sound levels produced by the conveyor system are higher than those of other component operations, noise controls targeting the conveyor system must be considered first for effective reduction of operator noise exposure. CMM conveyor noise is caused by impacts that occur between the conveyor deck and flight bars, which are used to move mined material to the discharge end of the machine. Research conducted by the National Institute for Occupational Safety and Health (NIOSH), with stakeholder involvement, has focused on producing noise treatments to reduce noise generated by the CMM conveyor system.



Figure 1.—Urethane-coated flight bar chain.

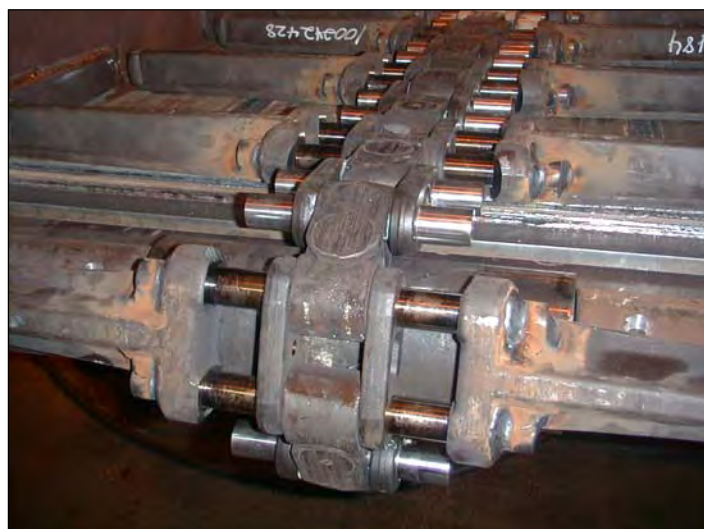


Figure 2.—Dual-sprocket driven chain.



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Two engineering noise controls have been developed to reduce CMM conveyor noise: the urethane-coated flight bar chain and the dual-sprocket chain. The urethane coating (Figure 1) used to treat the conveyor flight bars works by cushioning the impact blows of the bar on other parts of the conveyor. The dual-sprocket chain (Figure 2) reduces noise by maintaining a constant level of tension and by decreasing chain slack that otherwise produces high-intensity, noise-generating flight bar impacts at the conveyor transition points.

Results

Engineering noise controls for CMMs have been shown to reduce noise produced by the conveyor system. Laboratory sound power level measurements were conducted in the National Voluntary Laboratory Accreditation Program-accredited reverberation chamber at the NIOSH Pittsburgh Research Laboratory. These tests were performed to assess the acoustic performance of engineering noise controls in a controlled environment. A CMM with a urethane-coated flight bar chain installed reduced conveyor system noise by 7 dB(A), while a conveyor chain driven with the dual-sprocket system demonstrated a reduction of 3 dB(A).

To fully evaluate these noise controls, underground testing needed to be performed. The urethane-coated flight bar chain and dual-sprocket flight bar chain were installed on different machines at different underground coal mines. The urethane-coated flight bar chain demonstrated an 8-hour time-weighted average exposure reduction of 3 dB(A). The urethane coating also extended chain life by preventing any chain link failures during the 6-month test period. (A failure rate of three failed links in 4 months is typical for standard chains in similar mine conditions). The dual-sprocket chain showed promise for reducing operator exposure close to the Mine Safety and Health Administration (MSHA)

permissible exposure level (PEL) and for achieving compliance with Title 30 of the Code of Federal Regulations (CFR).

Recommendations

Targeting noise at the source through engineering noise controls reduces operator overexposure to noise. Title 30 of the CFR requires any mining machine operator who is above the PEL to use all feasible engineering and administrative noise controls. Both the urethane-coated flight bar chain and the dual-sprocket chain are considered by MSHA to be “technologically and administratively achievable.” These engineering controls should be considered mandatory when CMM operators are overexposed to noise.

For More Information

Publications on hearing loss prevention in the mining industry can be downloaded from the NIOSH Mining Web site at: <http://www.cdc.gov/niosh/mining/pubs/programareapubs14.htm>

For more information about the urethane-coated flight bar chain or the dual-sprocket chain for reducing noise exposure, contact Adam K. Smith, NIOSH Pittsburgh Research Laboratory, P.O. Box 18070, Pittsburgh PA 15236-0070; phone: (412) 386-6028; e-mail: ASmith9@cdc.gov.

To receive NIOSH documents or for more information about occupational safety and health topics, contact: **1-800-CDC-INFO** (1-800-232-4636), **1-888-232-6348** (TTY), e-mail: cdcinfo@cdc.gov, or visit the NIOSH Web site at <http://www.cdc.gov/niosh>

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